Bone and bone marrow involvement in sarcoidosis as detected by F18 FDG-PET/CT

Mostard RLM[1,2], Prompers L[3], Weijers RE[4], Kroonenburgh van MJPG[2,3], Wijnen PAHM[2,5], Geusens PPMM[2,6], Drent M[2,7]

[1]Dept of Respiratory Medicine, Atrium Medical Centre, Heerlen, [2]ild care team, [3]Dept of Nuclear Medicine, [4]Dept of Radiology, [5]Dept of Clinical Chemistry, [6]Dept of Internal Medicine, [7]Dept of Respiratory Medicine, Maastricht University Medical Centre+, Maastricht, The Netherlands

Introduction

The prevalence of bone involvement in sarcoidosis has been estimated to be 3-5%, mostly affecting the phalanges. However, the reported prevalence varies widely depending on the studied population and the used diagnostic techniques.[1-3] Until today the exact prevalence of bone involvement in sarcoidosis is unknown, due to these different results and since many lesions are asymptomatic.

Aim

The aim of this study was to assess the prevalence and distribution pattern of bone and bone marrow involvement as detected by PET/CT in sarcoidosis patients.

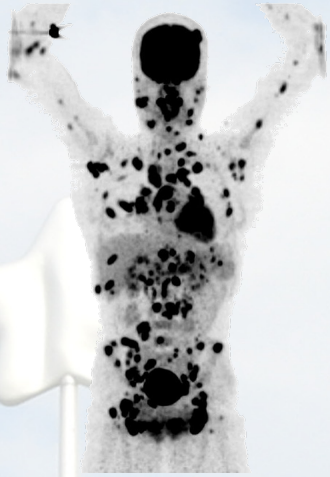
Methods

Between June 2006 and September 2010, 122 patients suffering from severe sarcoidosis that underwent a PET/CT and met the inclusion criteria were studied. In 94 (77%) of these, the PET/CT demonstrated positive findings associated with sarcoidosis. These 94 PET/CTs were screened for the presence of bone/bone marrow localizations. Additionally, low-dose CT scans were screened for other causes of increased bone uptake. Relevant clinical data were gathered retrospectively.

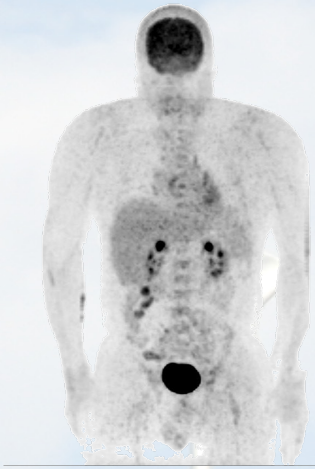
Results

Evidence for bone/bone marrow involvement was found in 34% of the 94 patients with PET positive findings. Of these patients, 60% showed obvious focal bone lesions at various localizations: axial skeleton (47%), pelvis (40%), extremities (34%), and skull (2%). In 40%, diffuse increased uptake in both axial and peripheral bone marrow, without focal lesions, were found. Both diffuse and focal uptake was seen in 34%, whereas in 25% only focal lesions. In all but two (6%) patients no bone abnormalities on low-dose CT were found.

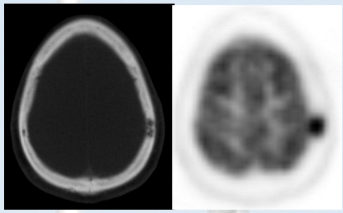
Figure 1. Example of a 40 year-old PET positive sarcoidosis patient with focal PET positive lesions at various localizations.



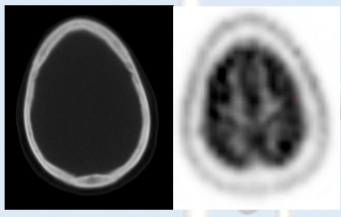
1a. Overview projection of the pretreatment FDG-PET scan showing diffusely increased focal FDG uptake in multiple bone and other organ localizations



1b. Overview projection of the FDG-PET scan after 18 months of treatment with prednisone and methotrexate showing obvious decrease of the FDG-uptake



1c. Corresponding transversal CT and PET images at cranial level showing a focal lytic bone lesion and increased FDG-uptake pretreatment



1d. Corresponding transversal PET and CT images at the same level as in c. after 18 months of treatment with prednisone and methotrexate showing normalization of the bone mineralization and FDG-uptake

Table 1. Summary of relevant clinical characteristics of the studied PET/CT positive sarcoidosis patients (n=94) divided in those patients without PET/CT bone lesions and those with PET/CT positive bone lesions (n=32).

	PET +/bone - patients (n=62)	PET +/bone + patients (n=32)
age (yrs)	49 (24-76)	42 (26-65) *
sex (male)	43 (69%)	11 (34%)**
time since diagnosis (yrs)	2 (1-26)	2 (1-27)
Caucasian/Black/Asian	56/4/2	30/2/0
Chest X-ray stage 0/I/II/III/IV	10/14/14/8/16	6/9/5/1/11
FVC (% pred)	90±27	92±24
DLCO (% pred)	71±22	76±14
Calcium (2.10-2.60 mmol/L)	2.31±0.07	2.31±0.07
Alkaline phosfatase (45-140 U/L)	97±51	95±27
Lactate dehydrogenase (0-480 U/L)	347±112	383±95
Haemoglobine (8.2-11.0 mmol/L)	9.2 (8.1-10.7)	8.7 (6.8-10.2)
Leucocytes (3.5-11.0 10^9/L)	7.3 (4.0-17.0)	7.2 (3.2-15.7)
Trombocytes (130-350 10^9/L)	266 (144-1033)	282 (173-448)
ACE (9-25 U/L)	25±22	18±6
sIL-2R (240- 3154 pg/mL)	3481±2722	4813±2922
Neopterin (<2.5 ng/mL)	3.9±4.0	3.9±2.1
CRP (2-9 µg/mL)	12±17	12±17

*= p<0.01; **= p<0.001

Conclusions

- More than one third of the PET/CT positive sarcoidosis patients had osseous abnormalities on PET/CT.
- The majority of these lesions (94%) could not be detected on low-dose CT.
- No single localization of preference was found.
- These preliminary results stress the value of PET/CT imaging in the assessment of bone/bone marrow involvement in sarcoidosis patients.

References

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3. Milman N, et al. Diagnostic value of routine radioisotope bone scanning in a series of 63 patients with pulmonary sarcoidosis. *Sarcoidosis Vasc Diffuse Lung Dis* 2000;17:67-70.

e-mail: r.mostard@atriummc.nl
website: www.ildcare.eu